

Wild Rice Study - Hydroponic Tests
 Summary of ANOVA and ANCOVA analyses
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Purpose

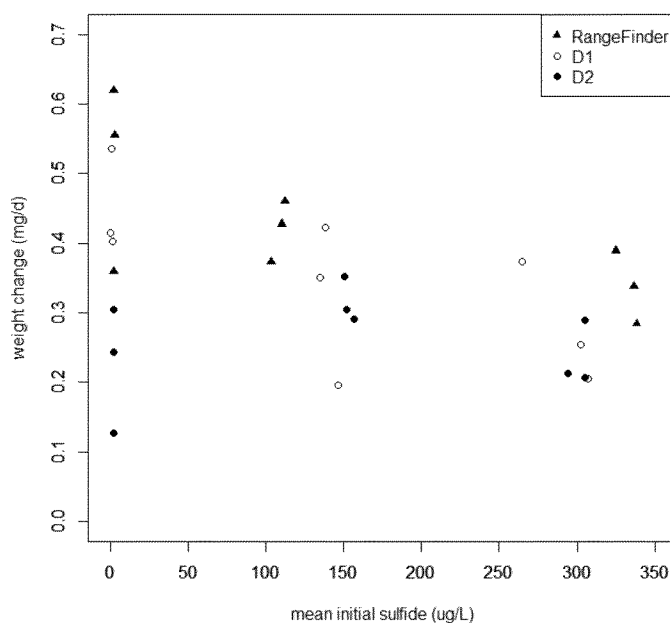
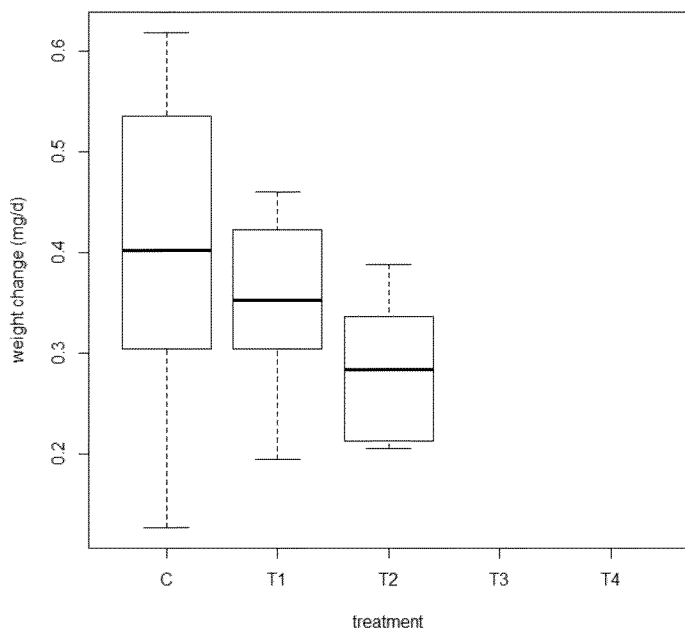
The purpose of this analysis was to test whether the effects of sulfide Treatment 2 on wild rice growth were significantly different from the Control.

Summary of results

The ANOVA shows that wild rice weight gain was significantly lower in Treatment 2 compared to the Control. The ANCOVA shows that wild rice weight gain declined significantly as sulfide concentrations increased across treatments.

Methods

Data from 3 treatments (Control, Treatment 1, Treatment 2) were pooled across the 3 tests (RangeFinder, Definitive1, Definitive2). Data from Treatment 3 and Treatment 4 were excluded because 1) they were irrelevant to the question at hand, and 2) sulfide exposures differed greatly between the tests for these treatment levels. A pooled ANOVA was used to test the effect of treatment on wild rice growth. Recognizing that sulfide concentrations at each treatment level are not exactly the same across experimental tests or between replicates, an ANCOVA was used to test the overall effect of mean sulfide and mean initial sulfide on growth.



Homogeneity of variance

This is a key underlying assumption of regression, ANOVA, and ANCOVA analyses. The Fligner-Killeen test of homogeneity of variance shows constant variance across the 3 treatments ($p = 0.1023$).

Analysis of Variance (ANOVA)

Y = weight change

X1 = treatment (3 factors: C, T1, T2)

X2 = test (3 factors: Rangefinder, Definitive1, Definitive2)

Model: $\text{lm}(\text{formula} = \text{weight_change_mgd.1} \sim \text{treatment} + \text{test}, \text{data} = \text{dataC12})$

Residuals:

	Min	1Q	Median	3Q	Max
Residuals	-0.183789	-0.047406	0.008178	0.049489	0.144656

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	0.40233	0.03810	10.560	4.44e-10 ***
treatmentT1	-0.04260	0.04174	-1.021	0.3185
treatmentT2	-0.11197	0.04174	-2.683	0.0136 *
testdefinitive2	-0.09144	0.04174	-2.191	0.0393 *
testrangefinder	0.07191	0.04174	1.723	0.0989 .

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.08854 on 22 degrees of freedom

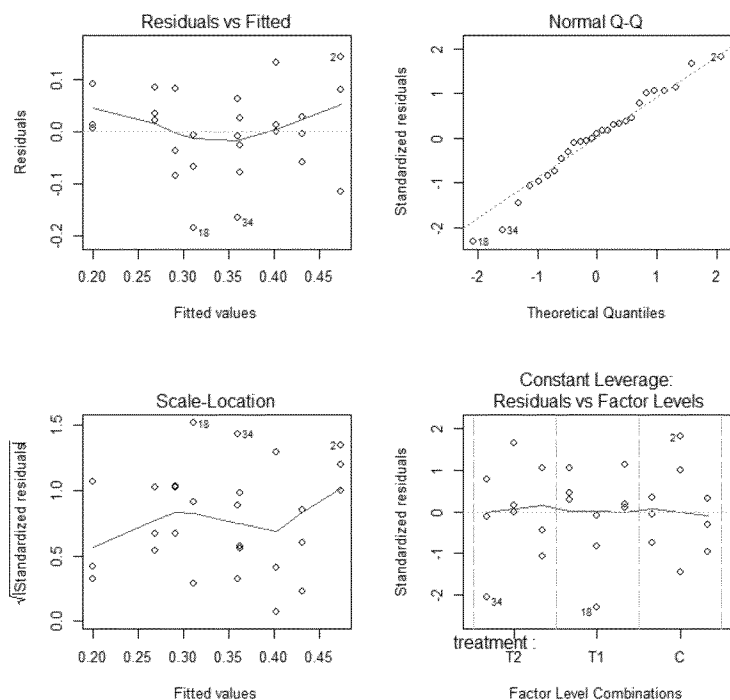
Multiple R-squared: 0.5081, Adjusted R-squared: 0.4187

F-statistic: 5.682 on 4 and 22 DF, p-value: 0.002687

Dunnnett Contrasts Test

Linear Hypotheses:

	Estimate	Std. Error	t value	Pr(> t)
T1 - C == 0	-0.04260	0.04174	-1.021	0.4997
T2 - C == 0	-0.11197	0.04174	-2.683	0.0252 *



Analysis of Covariance (ANCOVA)

Y = weight change

X1 = mean sulfide (continuous variable)

X2 = test (3 factors: Rangefinder, Definitive1, Definitive2)

Model: $\text{lm}(\text{formula} = \text{weight_change_mgd.1} \sim \text{meansulfide_ugL} + \text{test}, \text{data} = \text{dataC12})$

Residuals:

Min	1Q	Median	3Q	Max
-0.187013	-0.050485	0.004689	0.055989	0.141036

Coefficients:

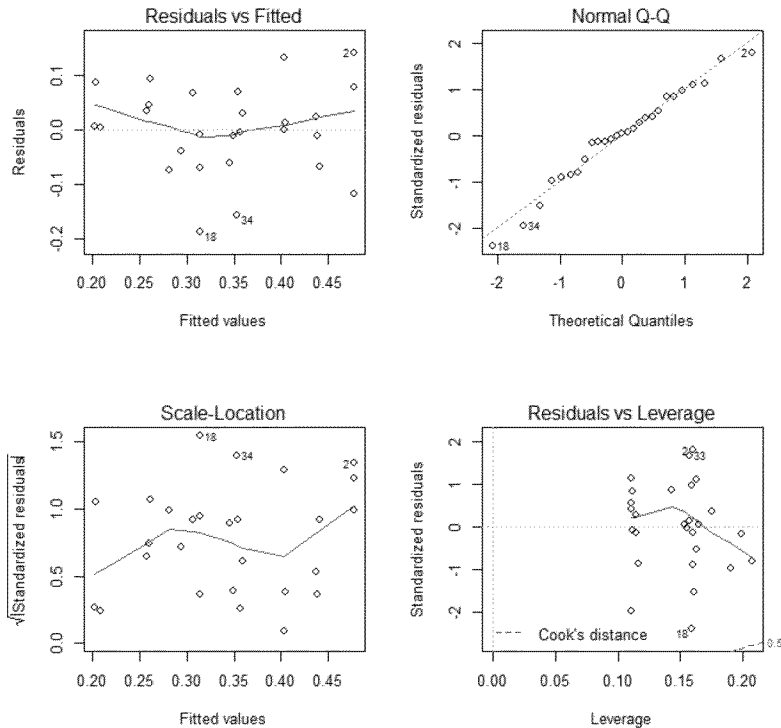
	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	0.4055675	0.0341243	11.885	2.68e-11 ***
meansulfide_ugL	-0.0007049	0.0002419	-2.914	0.00782 **
testdefinitive2	-0.0893059	0.0402887	-2.217	0.03681 *
testrangefinder	0.0739110	0.0402879	1.835	0.07954 .

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.08545 on 23 degrees of freedom

Multiple R-squared: 0.521, Adjusted R-squared: 0.4585

F-statistic: 8.338 on 3 and 23 DF, p-value: 0.0006228



Analysis of Covariance (ANCOVA)

Y = weight change

X1 = mean initial sulfide (continuous variable)

X2 = test (3 factors: Rangefinder, Definitive1, Definitive2)

Model: $\text{lm}(\text{formula} = \text{weight_change_mgd.1} \sim \text{meaninitialsulfide_ugL} + \text{test}, \text{data} = \text{dataC12})$

Residuals:

Min	1Q	Median	3Q	Max
-0.188002	-0.052064	0.004537	0.056428	0.141972

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	0.4042632	0.0343042	11.785	3.17e-11 ***
meaninitialsulfide_ugL	-0.0003711	0.0001307	-2.840	0.00928 **
testdefinitive2	-0.0884074	0.0405717	-2.179	0.03983 *
testrangefinder	0.0734192	0.0405611	1.810	0.08337 .

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.08604 on 23 degrees of freedom

Multiple R-squared: 0.5144, Adjusted R-squared: 0.4511

F-statistic: 8.121 on 3 and 23 DF, p-value: 0.0007245

